

**Fungi of the Russian Far East. 3. Species of *Amanita*
(*Basidiomycota*) new to Russia from the Primorye Territory**

E. F. Malysheva, A. A. Kiyashko, A. E. Kovalenko

Komarov Botanical Institute, Prof. Popov Str., 2, St. Petersburg, 197376, Russia;
ef.malysheva@gmail.com

Abstract. *Amanita pallidorosea*, *A. longistriata* and *A. farinosa* are recorded for the first time for Russia from the Primorye Territory. Their descriptions and illustrations are provided.

Keywords: *Amanita*, Russian Far East, new records, morphology, ITS.

Грибы Дальнего Востока России. 3. Новые для России
виды рода *Amanita* (*Basidiomycota*) из Приморского края

Е. Ф. Малышева, А. А. Кияшко, А. Е. Коваленко

Ботанический институт им. В. Л. Комарова РАН, ул. Профессора Попова, д. 2,
Санкт-Петербург, 197376, Россия; ef.malysheva@gmail.com

Резюме. В статье приводятся подробные описания и иллюстрации трех новых для России видов рода *Amanita* (*A. pallidorosea*, *A. longistriata* и *A. farinosa*), найденных в Приморском крае.

Ключевые слова: *Amanita*, Дальний Восток России, новые находки, морфология, ITS.

The genus *Amanita* Pers. is one of the well-known genera in *Basidiomycota* distributed worldwide. Most species are known to be ectomycorrhizal with different forest trees and play an important role in ecosystems. More than 500 species are described in the world (Yang, 2000). During the past decade, the genus *Amanita* has received much taxonomical attention in temperate and tropical regions and more than 10 new taxa have been described (Yang *et al.*, 2001, 2004; Zhang *et al.*, 2010). However, the knowledge about the genus from the Primorye Territory is rather limited — no more than sixteen *Amanita* species were registered at present (Vassilieva, 1973; Flora..., 2006, 2007). Our intensive investigation on agaricoid fungi demonstrated that the diversity of *Amanita* is much higher in the Primorye Territory than previously reported in mentioned papers. This paper is a part of a series dealing with the agaricoid fungi of the Russian Far East (Malysheva *et al.*, 2013; Kiyashko *et al.*, 2014).

Materials and Methods

Studied specimens were collected in 2011–2013. Macromorphological descriptions were based on the fresh material and colour photos of basidi-

ocarps. Colour codes are given based on A. Kornerup and J. H. Wanscher (1978). Micromorphological data were obtained from the dried material mounted in 5 % KOH, Congo Red or Melzer's reagents using AxioImagerA1 light microscope and a Zeiss AxioCam MRc5 digital camera with AxioVision SE64 version 4.8.3.0 software. In basidiospore dimensions Q is used to mean «length/width ratio» of a spore in side view; \bar{Q} means the average Q of all spores measured \pm standard deviation. The total number of basidiospores measured for each taxon was not less than thirty. The drawings were performed with Inkscape version 0.48 free software.

Collected specimens were deposited in the Mycological Herbarium of the Komarov Botanical Institute RAS (LE). All sequences newly generated for this study were deposited in GenBank with corresponding accession numbers.

Results

As a result of studying *Amanita* species collected during the mycological expeditions to the Sikhote-Alin and Kedrovaya Pad' Nature Reserves, three noteworthy and new to Russia species were discovered. All these species are described and illustrated herein.

Amanita farinosa Schwein., 1822, Schriften Naturf. Ges. Leipzig, 1: 79 (Fig. 1; Plate I, 3).

Basidiocarps small-sized. **Pileus** 20 mm in diam., hemispherical when young, then convex, becoming plano-convex with slightly depressed centre, dry, with powder-like volval remnants all over the surface but more dense in the centre; birch bark or brownish grey (6B2, 6C2) or sepia, with pale ochre margin; margin strongly tuberculate-striate up to half the radius, non-appendiculate. **Lamellae** almost free, just touching stipe, subcrowded, white, with concolourous and slightly flocculose edge; lamellulae truncate. **Stipe** 30 \times 3.5 mm, subcylindric, slightly broadened towards base, without distinct basal bulb; whitish to pale yellow or yellowish white (3A2), entirely flocculose, having distinct brownish powdery area of universal veil at base. **Annulus** absent.

Lamellar trama bilateral. **Subhymenium** 25–40 μ m thick, with several layers of globose, subglobose or broadly clavate, hyaline and thin-walled cells, 12–20 \times 8–16 μ m. **Basidia** 27–36 \times 7–10 μ m, clavate, 4-spored, without basal clamps. **Basidiospores** 7.8–9.2(9.5) \times (5.6) 6–7(7.6) μ m [$Q = (1.11)1.18$ – $1.47(1.53)$, $\bar{Q} = 1.31 \pm 0.11$], broadly ellipsoid to ellipsoid, rarely elongate, inamyloid, thin-walled, hyaline; apiculus small, sublateral. **Lamellar edge** sterile, composed of numerous subglobose, clavate or ovoid elements, 8–23 \times 6–13.5 μ m, single

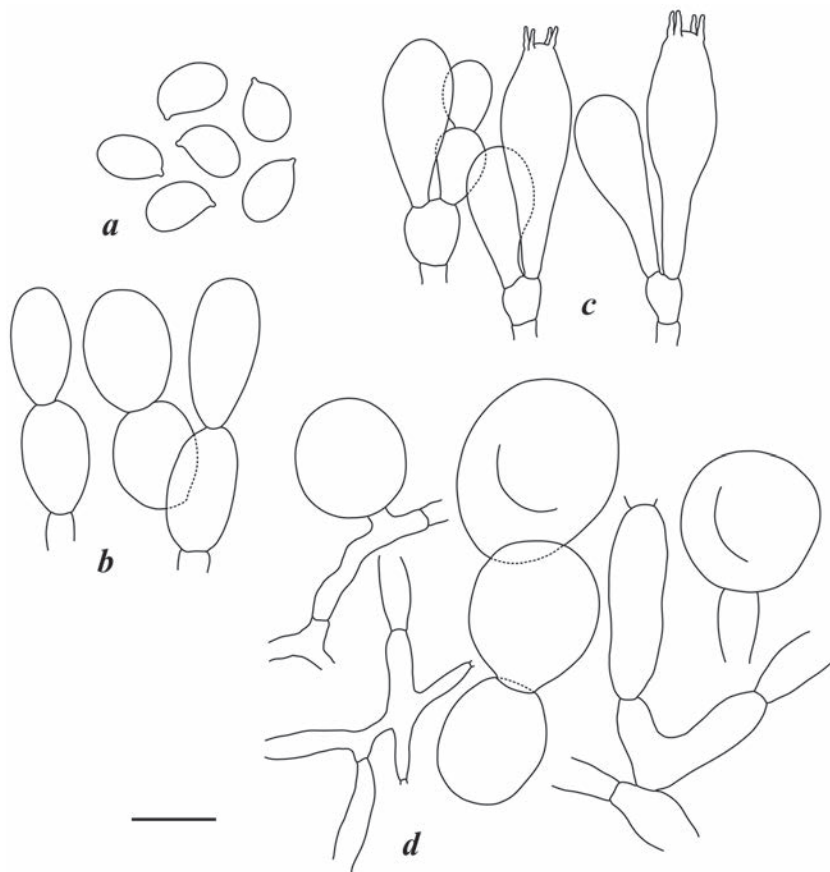


Fig. 1. Microscopic features of *Amanita farinosa* (LE 296435).
a — basidiospores; *b* — cells of lamellar edge; *c* — basidia and elements of subhymenium; *d* — elements of powdery volva at stipe base. Scale bar: 10 μ m.

or in short chains, hyaline, thin-walled. Pileipellis 90–180 μ m thick; the upper layer comprising, interwoven and slightly branched, densely arranged, filamentous hyphae 2–4 μ m wide, thin- or slightly thick-walled, hyaline or yellowish brown; the lower layer has similar structure, hyphae up to 6 μ m wide. Volval remnants on pileus surface made up of scattered, interwoven and anastomosing, sometimes inflated, filamentous hyphae, 2.7–8 μ m wide, slightly thick-walled, hyaline; mixed with numerous, strongly inflated, subglobose, ellipsoid, oviform or pyriform,

thick-walled cells, 15–60 × 15–50 µm, with brown intracellular pigment. Powdery volva at stipe base consisting of anastomosing filamentous, slightly thick-walled hyphae, 5–11 µm wide, often with inflated single segments, hyaline or yellowish, occasionally incrustated; mixed with plentiful subglobose, pyriform, subcylindrical or ellipsoid elements, 15–55 × 8–45 µm, often in short chains, thick-walled, with pale yellow-brown intracellular pigment. Clamps absent in all tissues.

Habitat and distribution: Solitary on soil in mixed forest. Distributed in eastern USA, southeastern Canada and Costa Rica. Recently it has been found in eastern Asia (Kim *et al.*, 2013b).

Specimen examined: **Russia**, Primorye Territory, Kedrovaya Pad' Nature Reserve, valley of Kedrovaya River, coniferous-broad-leaved forest, on soil, 08.09.2011, A. Kovalenko, LE 296435, GenBank KJ739808 (ITS), KJ739815 (LSU).

Note: *Amanita farinosa* belongs to the subgenus *Amanita* section *Amanita* (Tulloss, 2014c). This species is similar to several taxa which also have pulverulent pileus surface and small- to medium-sized basidiocarps: *A. obsita* Corner et Bas, *A. nehuta* J. S. Ridl. and *A. subvaginata* (Cleland et Cheel) E.-J. Gilbert. *A. obsita* differs from *A. farinosa* by light-coloured pileus and smaller basidiospores [(5.5)6.5–7 × 5.5–6.5(7) µm] (Sanmee *et al.*, 2008). *A. nehuta*, originally described from New Zealand, has larger and robust basidiocarps with distinct basal bulb on stipe and appendiculate pileus margin (Tulloss, 2014a). *A. subvaginata*, known from Australia, can be separated from *A. farinosa* by its pileus coloration, bulbous base with marginate volva and globose basidiospores (Tulloss, 2014b).

Amanita longistriata S. Imai, 1938, J. Coll. agric., Hokkaido Imp. Univ. 43: 11. (Fig. 2; Plate I, 1, 2).

Basidiocarps medium- to large-sized. Pileus 60–80 mm in diam., hemispherical when young, then convex, becoming appanate, with low broad umbo or with depressed centre, glabrous, often viscid or subviscid when wet, with volval remnants in the form of appressed to innate small patches or squamules, concolorous with surface, densely arranged at centre and scarce towards margin; greyish brown, light brown (6D3-4) or brown (6E4) with pale margin, sometimes very light-coloured, with almost white or pinkish (7A2-3) margin and darker disc; margin strongly striate or sulcate up to half the radius, often undulating, non-appendiculate. Lamellae free, just touching stipe or almost narrowly adnate, subdistant, pinkish white then pink, with flocculose to subdenticulate, whitish or concolourous edge; lamellulae not defined. Stipe 90–150 × 8–15 mm, subcylindric, slightly broadened towards base, hollow, without distinct basal bulb; whitish to yellowish or pinkish white (3A2, 7A2), flocculose-squamulose above annulus, smooth below. Volva caliciform or saccate, thin and membranous, sometimes rather thick, firm, with free

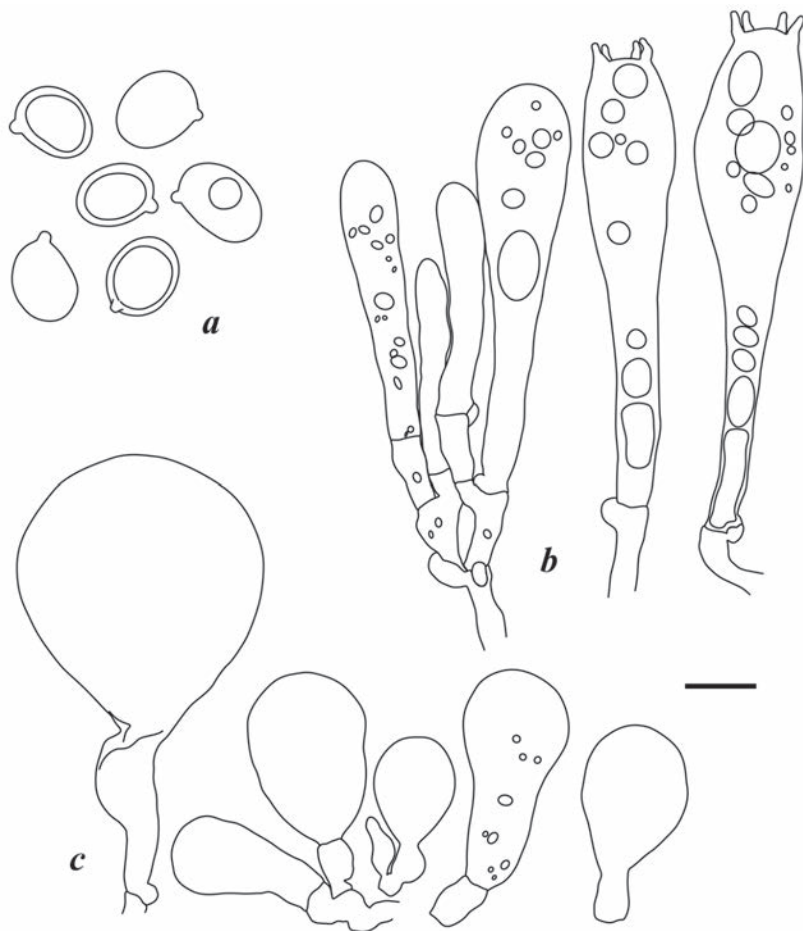


Fig. 2. Microscopic features of *Amanita longistriata* (LE 296426).
a — basidiospores; *b* — basidia and elements of subhymenium; *c* — cells of lamellar edge. Scale bar: 10 μ m.

wide limb, often lobed, outer surface velvety, both surface white. An n u - l u s present, at upper part of stipe, rather wide, thin, membranous, fragile, white, with floccose edge and striate outer surface.

Lamellar trama bilateral. Subhymenium 27–40 μ m thick, with 2–3 layers of globose, subglobose, broadly clavate or irregularly shaped, hyaline and thin-walled cells, 10–20 \times 7–18 μ m. Basidia 40–70(80) \times 8–16 μ m, clavate, 4-spored, with basal clamps.

Basidiospores 10–13(16) × (7.8)8.2–10.5(11.6) μm [$Q = (1.03)1.15–1.36(1.47)$, $Q = 1.26 ± 0.06$], broadly ellipsoid or ellipsoid, rarely subglobose, inamyloid, thin-walled, hyaline; apiculus small, sublateral. **Lamellar edge** sterile, composed of numerous subglobose, clavate or pyriform cells, 20–60 × 15–45 μm, single or in short chains, hyaline, thin-walled. **Pileipellis** 90–120 μm thick; the upper layer up to 60 μm, gelatinized, comprising filamentous, undifferentiated, hyaline hyphae 8–11 μm wide; the lower layer (30–60 μm thick) made up of more compactly arranged, interwoven, filamentous, thin-walled, hyaline or with intracellular yellowish pigment hyphae 7–10 μm wide. **Volval limb** on the stipe base made up of interwoven, thin-walled, hyaline, sometimes anastomosing, filamentous hyphae 3–12 μm wide; terminal elements numerous, strongly inflated, ellipsoid, clavate, oviform or subglobose, thin-walled, 40–100 × 20–55 μm; vascular hyphae rare, tortuous, up to 7 μm wide; inner surface of the limb gelatinized, comprises interwoven, filamentous thin-walled hyphae 2–4.5 μm wide; outer surface of the limb consisting of interwoven, filamentous, thin-walled hyphae 2.5–6 μm wide, hyaline or with yellow-brown intracellular pigment; inflated cells rare. **Annulus** consisting of branching and anastomosing, interwoven, thin- or slightly thick-walled, 2.5–7 μm wide filamentous hyphae, mixed with occasional, hyaline, thin-walled, subglobose, broadly ellipsoid or pyriform terminal cells, 20–40 × 15–30 μm; vascular hyphae scattered, hyaline, up to 6 μm wide. **Clamps** common in all tissues.

Habitat and distribution: Solitary or scattered on soil in mixed or coniferous forests. It was originally described from Japan. Also known from South Korea and China (Yang, Doi, 1999).

Specimens examined: **Russia**, Primorye Territory, Sikhotealin Nature Reserve, vicinity of Yasnaya Reserve station, coniferous-broadleaved forest, on soil, 21.08.1996, A. Kovalenko, LE 296421; *ibid.*, floodplain of Yasnaya River, coniferous-broadleaved forest (*Larix*, *Betula* and *Quercus*), on soil, 27.08.2013, E. Malysheva, LE 296419, GenBank KJ739810 (ITS); *ibid.*, floodplain of Yasnaya River, mixed forest, on soil, 21.08.2013, O. Morozova, LE 296420, GenBank KJ739811 (ITS); the same reserve, vicinity of Ust'-Serebryany reserve station, bank of Serebryanka River, oak forest with sporadic birch, maple and coniferous trees, 04.09.1996, O. Morozova, LE 296429, GenBank KJ739812 (ITS); the same reserve, upper stream Sukhoi, mixed forest (*Quercus mongolica*, *Betula costata*, *Pinus koraiensis*), on soil, 44°59'44" N, 136°30'18" E, 10.08.2012, A. Kiyashko, LE 296426, GenBank KJ739809 (ITS).

Note: *Amanita longistriata* belongs to the subgenus *Amanita* section *Caesareae* Singer. The remarkable features of this species are its strongly striate pileus and beau-

tiful clearly pink lamellae. Based on combination of these characters *A. longistriata* resembles *A. incarnatifolia* Z. L. Yang in the field. The latter, originally described from pine forests China from, differs from *A. longistriata* by shorter striation of pileus margin and narrower basidiospores (not exceeding 9 μm broadwise) (Yang, 1997). Another representative of sect. *Caesareae* having distinctly pink lamellae is *A. roseolamellata* A. E. Wood, but it differs from *A. longistriata* at least by conspicuously narrower basidiospores [6–8.5(9) μm wide] and occurring in specific sclerophyll forests in Australia (Wood, 1997).

Amanita pallidorosea P. Zhang et Zhu L. Yang, 2010, *Fungal Diversity*, 42: 125 (Fig. 3; Plate II).

Basidiocarps medium- to large-sized. Pileus 30–95 mm in diam., hemispherical, ovoid or rounded conical when young, then broadly conical, convex, becoming applanate with low broad umbo, glabrous, often subviscid when wet, with yellowish white umbo (4A3-4) surrounded by pinkish (9A2-3, 10A2-3) or pastel red (9A4) circle, becoming white to whitish toward margin; margin slightly incurved, faintly striate or non-striate, non-appendiculate. Lamellae free, crowded, white or slightly pinkish with age, with concolorous edges. Stipe 90–160 \times 6–13 mm, subcylindric, slightly broadened towards base, with distinct basal bulb up to 3 cm wide; whitish to yellowish white (3A2-3), covered with white flaked squamules in numerous belts. Volva membranous, firm, with free wide limb, outer surface velvety, both surface white. Annulus present, at upper part of stipe, wide, thin, membranous, rather stable, with undulating edge, white or slightly yellowish.

Lamellar trama bilateral. Subhymenium 18–35 μm thick, with 2–4 layers of globose, subglobose, broadly clavate or irregularly shaped, hyaline and thin-walled cells, 8–22 \times 7–15 μm . Basidia 27–40 \times 8–11 μm , clavate, 4-spored. Basidiospores 6.8–8.2(9.5) \times 6.8–7.8(9) μm [Q = 1.05–1.05(1.1), Q = 1.02 \pm 0.03], globose to subglobose, amyloid, thin-walled, hyaline; apiculus small, sublateral. Lamellar edge sterile, composed of numerous subglobose, clavate or broadly utriform cells, 19–50 \times 8–25 μm , single or in short chains, hyaline, thin-walled. Pileipellis 100–150 μm thick; the upper layer up to 100 μm , slightly gelatinized, comprising filamentous undifferentiated, hyaline hyphae 8–12 μm wide; the lower layer (50–60 μm thick) made up of more compactly arranged, interwoven, non-gelatinized, filamentous, thin-walled, hyaline or with intracellular yellowish pigment hyphae 8–10 μm wide. Volval limb at the stipe base made up of loosely interwoven, thin-walled, hyaline, sometimes anastomosing, filamentous hyphae 4–10 μm wide; terminal elements strongly inflated, subcylindrical, clavate, oviform or subglobose, thin-walled, 40–65 \times 12–27 μm ; inner surface of the limb gelatinized, comprises filamentous thin-walled

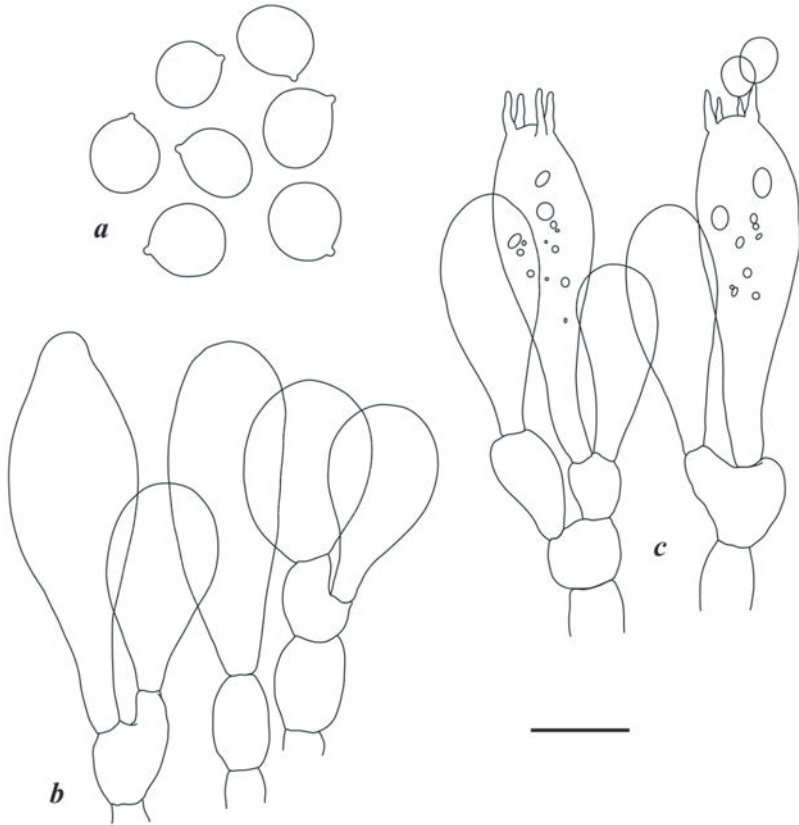


Fig. 3. Microscopic features of *Amanita pallidorozea* (LE 296427).
a — basidiospores; *b* — cells of lamellar edge; *c* — basidia and elements of subhymenium. Scale bar: 10 μm .

hyphae 2.7–5.5 μm wide; outer surface of the limb comprises filamentous thin-walled hyphae up to 10 μm wide. Annulus composed of branching and anastomosing, interwoven, thin- or slightly thick-walled, 3–8 μm wide filamentous hyphae, mixed with numerous, hyaline, slightly thick-walled, globose, broadly ellipsoid or pyriform terminal cells, 25–100 \times 20–50 μm . Clamps absent in all tissues.

Habitat and distribution: Solitary or scattered on soil in forests with *Quercus mongolica*. Originally described from China. Also known from Korea (Kim *et al.*, 2013a). Presently known that *Amanita pallidorozea* is ectomycorrhizal fungus of *Fagaceae*.

Specimens examined: **Russia**, Primorye Territory, Sikhote-Alin Nature Reserve, Baklanya mountain, dry oak forest with *Quercus mongolica*, on soil, 44°54'814" N, 136°32'127" E, 18.08.2013, E. Malyshева, LE 296434, GenBank KJ739813 (ITS); *ibid.*, 18.08.2013, E. Malyshева, O. Morozova, LE 296427, GenBank KJ739814 (ITS).

Note: *Amanita pallidorosea* belongs to the subgenus *Lepidella* (E.-J. Gilbert.) Corner et Bas section *Phalloideae* (Fr.) Qué. The main distinguishing character of this species is rose tint of its pileus, but entirely white basidiocarps are also typical for this taxon. In the field the latter forms can be mistaken for *Amanita virosa* (Fr.) Bertill., *A. subjunquillea* var. *alba* Z. L. Yang, *A. oberwinklerana* Z. L. Yang et Y. Doi, *A. bisporigera* Atk. and *A. ocreata* Peck on account of the large and whitish basidiocarps of similar appearance. *A. virosa* differs from *A. pallidorosea* by larger and more ellipsoid basidiospores (8–11 × 7.5–10 μm), longer basidia and different structure of annulus (Neville, Poumarat, 2004). *A. subjunquillea* var. *alba*, originally described from China, never has rose tint in pileus, besides its basidiocarp has a distinct yellow reaction with 5 % KOH. *A. oberwinklerana*, described from Japan, is distinguished from *A. pallidorosea* by the presence of volval remnants on pileus and larger ellipsoid basidiospores [(7.5)8–10.5(12.5) × (5.5)6.5–8(8.5) μm] (Yang, Doi, 1999). Both *A. bisporigera* and *A. ocreata* are known only from North America. *A. bisporigera* has predominantly 2-spored basidia and slightly larger basidiospores (Tulloss *et al.*, 1995). *A. ocreata* differs in having larger basidiospores [(6.8) 8.8–12.0(13.8) × (5.9)6.3–8.5(10.8) μm] and yellow reaction with 5 % KOH.

Discussion

Amanita farinosa is found only once in the Primorye Territory in coniferous-broadleaved forest. The species seems to be rare in the studied area, though its small-sized basidiocarps may be overlooked in the field causing underestimation of its actual occurrence.

Amanita longistriata is common in the Sikhote-Alin Nature Reserve and was collected in different types of forest. It is probably a mycorrhizal symbiont of several taxa of coniferous trees. *A. longistriata*, recorded in Japan, differs by light-coloured pileus, absence of volval remnants on the pileus surface and shorter basidiospores [(8)9–12(13.5) μm lengthwise], according to description given by some authors (Yang, Doi, 1999); other characters agree with our collections. Nevertheless, the ITS sequences of our collections (LE 296426, LE 296419, LE 296420) are 100 % identical with sequence from Japan (GenBank AB015678).

Amanita pallidorosea is one of the deadly poisonous species from the section *Phalloideae*. In the Sikhote-Alin Nature Reserve this species was found repeatedly in oak forests where it had abundant fruiting. Noteworthy, that it was recorded simultaneously with other very similar species *A. virosa* in the same plant communities. Due to difficulties in separating these two species, *A. pallidorosea* was probably known before in

the studied territory under the name *A. virosa*. In the Primorye Territory *A. pallidorosea* is supposed to form ectomycorrhiza with *Quercus mongolica*. Molecular data showed 100 % identity of the ITS sequences of our specimens of *A. pallidorosea* (LE 296434, LE 296427) with three Chinese sequences retrieved from GenBank (JX998037, JX998036 and FJ176735) and only four bases differences with sequence of Korean specimen (KF245915), suggesting conspecificity of collections from the different geographical sites.

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References

- Flora, vegetation and mycobiota of the reserve «Ussuriyskiy»* / Azbukina Z. M., Bardunov L. V., Bezdeleva T. A., Bogacheva A. V., Bulakh E. M., Vasilyeva Lar. N., Govorova O. K., Egorova L. N., Zhabyko E. V., Nikulina T. V., Rodnikova I. M., Skirina I. F., Tarankov V. I., Fedina L. A., Cherdantseva V. Ya. 2006. Vladivostok: 300 p. (In Russ.).
- Flora, mycobiota and vegetation of the nature reserve «Bastak»*. 2007. Vladivostok: 283 p. (In Russ.).
- Kim Ch. S., Jo J. W., Kwag Y.-N., Kim J.-H., Shrestha B., Sung G.-H., Han S.-K. 2013a. Taxonomic study of *Amanita* subgenus *Lepidella* and three unrecorded *Amanita* species in Korea. *Mycobiology*. 41(4): 183–190.
- Kim Ch. S., Jo J. W., Kwag Y.-N., Oh J., Shrestha B., Sung G.-H., Han S.-K. 2013b. Four newly recorded *Amanita* species in Korea: *Amanita* sect. *Amanita* and sect. *Vaginatae*. *Mycobiology*. 41(3): 131–138.
- Kiyashko A. A., Malysheva E. F., Antonin V., Svetasheva T. Yu., Bulakh E. M. 2014. Fungi of the Russian Far East. 2. New species and new records of *Marasmius* and *Cryptomarasmius* (Basidiomycota). *Phytotaxa* (in press).
- Kornerup A., Wanscher J. H. *Methuen handbook of colour*. 1978. London: 252 p.
- Malysheva E. F., Svetasheva T. Yu., Bulakh E. M. 2013. Fungi of the Russian Far East. 1. New combination and new species of the genus *Leucoagaricus* (Agaricaceae) with red-brown basidiomata. *Mikol. Fitopatol.* 47(3): 169–179.
- Neville P., Poumarat S. 2004. Amaniteae: *Amanita*, *Limacella* and *Torrendia*. *Fungi Europaei*. 9: 1–1120.
- Sanmee R., Tuloss R. E., Lumyong P., Dell B., Lumyong S. 2008. Studies on *Amanita* (Basidiomycetes: Amanitaceae) in Northern Thailand. *Fungal Diversity*. 32: 97–123.

- Tulloss R. E., Stephenson S. L., Bhatt R. P., Kumar A. 1995. Studies on Amanita (Amanitaceae) in West Virginia and adjacent areas of the mid-Appalachians. Preliminary results. *Mycotaxon*. 56: 243–293.
- Tulloss R. E. 2014a. Studies in the Amanitaceae. Amanita nehuta G. S. Ridl. <http://www.amanitaceae.org/?Amanita%20nehuta> (accessed: 19 April 2014).
- Tulloss R. E. 2014b. Studies in the Amanitaceae. Amanita subvaginata (Cleland & Cheel) E.-J. Gilbert. <http://www.amanitaceae.org/?Amanita%20subvaginata> (accessed: 19 April 2014).
- Tulloss R. E. 2014c. Studies in the Amanitaceae. Amanita farinosa Schwein. [http://www.amanitaceae.org/?Amanita farinosa](http://www.amanitaceae.org/?Amanita%20farinosa) (accessed: 22 April 2014).
- Vassilieva Lj. N. 1973. *Agaricovye shlyapochnye griby (por. Agaricales) Primorskogo Kraja*. [Agaricoid fungi of the Primorye Territory]. Leningrad: 331 p. (In Russ.).
- Wood A. E. 1997. Studies in the genus Amanita (Agaricales) in Australia. *Austral. Syst. Bot.* 10: 723–854.
- Yang Z. L. 1997. Die Amanita-Arten von Südwestchina. *Biblioth. Mycol.* 170: 1–240.
- Yang Z. L. 2000. Species diversity of the genus Amanita (Basidiomycetes) in China. *Acta Botanica Yunnanica*. 22: 135–142.
- Yang Z. L., Doi Y. 1999. A contribution to the knowledge of Amanita (Amanitaceae, Agaricales) in Japan. *Bull. Natl. Sci. Mus. Tokyo. Ser. B.* 25(3): 108–130.
- Yang Z. L., Li T. H., Wu X. L. 2001. Revision of Amanita collections made from Hainan, Southern China. *Fungal Diversity*. 6: 149–165.
- Yang Z. L., Weiss M., Oberwinkler F. 2004. New species of Amanita from the eastern Himalaya and adjacent regions. *Mycologia*. 96(3): 636–646.
- Zhang P., Chen Z. H., Xiao B., Tolgor B., Bao H. Y., Yang Z. L. 2010. Lethal amanitas of East Asia characterized by morphological and molecular data. *Fungal Diversity*. 42: 119–133.

Литература

- [Flora...] *Флора, растительность и микобиота заповедника «Уссурийский»* / Азбукина З. М., Бардунов Л. В., Безделева Т. А., Богачева А. В., Буллах Е. М., Васильева Лар. Н., Говорова О. К., Егорова Л. Н., Жабыко Е. В., Никулина Т. В., Родникова И. М., Скирина И. Ф., Таранков В. И., Федина Л. А., Черданцева В. Я. 2006. Владивосток: 300 с.
- [Flora...] *Флора, микобиота и растительность заповедника «Бастак»*. 2007. Владивосток: 283 с.
- Kim Ch. S., Jo J. W., Kwag Y.-N., Kim J.-H., Shrestha B., Sung G.-H., Han S.-K. 2013a. Taxonomic study of Amanita subgenus Lepidella and three unrecorded Amanita species in Korea. *Mycobiology*. 41(4): 183–190.
- Kim Ch. S., Jo J. W., Kwag Y.-N., Oh J., Shrestha B., Sung G.-H., Han S.-K. 2013b. Four newly recorded Amanita species in Korea: Amanita sect. Amanita and sect. Vaginatae. *Mycobiology*. 41(3): 131–138.
- Kiyashko A. A., Malysheva E. F., Antonin V., Svetasheva T. Yu., Bulakh E. M. 2014. Fungi of the Russian Far East. 2. New species and new records of Marasmius and Cryptomarasmius (Basidiomycota). *Phytotaxa* (in press).
- Kornerup A., Wanscher J. H. *Methuen handbook of colour*. 1978. London: 252 p.

- Malysheva E. F., Svetasheva T. Yu., Bulakh E. M. 2013. Fungi of the Russian Far East. 1. New combination and new species of the genus *Leucoagaricus* (Agaricaceae) with red-brown basidiomata. *Mikol. Fitopatol.* 47(3): 169–179.
- Neville P., Poumarat S. 2004. Amaniteae: *Amanita*, *Limacella* and *Torrendia*. *Fungi Europaei*. 9: 1–1120.
- Sanmee R., Tulloss R. E., Lumyong P., Dell B., Lumyong S. 2008. Studies on *Amanita* (Basidiomycetes: Amanitaceae) in Northern Thailand. *Fungal Diversity*. 32: 97–123.
- Tulloss R. E., Stephenson S. L., Bhatt R. P., Kumar A. 1995. Studies on *Amanita* (Amanitaceae) in West Virginia and adjacent areas of the mid-Appalachians. Preliminary results. *Mycotaxon*. 56: 243–293.
- Tulloss R. E. 2014a. Studies in the Amanitaceae. *Amanita nehuta* G. S. Ridl. <http://www.amanitaceae.org/?Amanita%20nehuta> (accessed: 19 April 2014).
- Tulloss R. E. 2014b. Studies in the Amanitaceae. *Amanita subvaginata* (Cleland & Cheel) E.-J. Gilbert. <http://www.amanitaceae.org/?Amanita%20subvaginata> (accessed: 19 April 2014).
- Tulloss R. E. 2014c. Studies in the Amanitaceae. *Amanita farinosa* Schwein. [http://www.amanitaceae.org/?Amanita farinosa](http://www.amanitaceae.org/?Amanita%20farinosa) (accessed: 22 April 2014).
- [Vassilieva] Васильева Л. Н. *Агариковые шляпочные грибы (пор. Agaricales) Приморского края*. 1973. Л.: 331 с.
- Wood A. E. 1997. Studies in the genus *Amanita* (Agaricales) in Australia. *Austral. Syst. Bot.* 10: 723–854.
- Yang Z. L. 1997. Die *Amanita*-Arten von Südwestchina. *Biblioth. Mycol.* 170: 1–240.
- Yang Z. L. 2000. Species diversity of the genus *Amanita* (Basidiomycetes) in China. *Acta Botanica Yunnanica*. 22: 135–142.
- Yang Z. L., Doi Y. 1999. A contribution to the knowledge of *Amanita* (Amanitaceae, Agaricales) in Japan. *Bull. Natl. Sci. Mus. Tokyo. Ser. B.* 25(3): 108–130.
- Yang Z. L., Li T. H., Wu X. L. 2001. Revision of *Amanita* collections made from Hainan, Southern China. *Fungal Diversity*. 6: 149–165.
- Yang Z. L., Weiss M., Oberwinkler F. 2004. New species of *Amanita* from the eastern Himalaya and adjacent regions. *Mycologia*. 96(3): 636–646.
- Zhang P., Chen Z. H., Xiao B., Tolgor B., Bao H. Y., Yang Z. L. 2010. Lethal amanitas of East Asia characterized by morphological and molecular data. *Fungal Diversity*. 42: 119–133.



Plate I. Basidiocarps.

1 — *Amanita longistriata* (LE 296426); 2 — *Amanita longistriata* (LE 294419); 3 —
Amanita farinosa (LE 296435). Scale bars: 1 cm.



Plate II. Basidiocarps of *Amanita pallidorosea*.
1 — LE 296434; 2 — LE 296427. Scale bars: 1 cm.